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WEST EUROPE REPORT

SCIENCE AND TECHNOLOGY

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CONTENTS

FIRST OPERATING RESULTS FROM ALMEIRA SOLAR POWER PLANT

Duesseldorf BWK: BRENNSTOFF-WAERME-KRAFT in German May 82 p 250

[Text] Initial operating results from the 500-kW solar power plant in Almeira in southern Spain, which began experimental operation in mid-1981, are now available. The core of the plant is the receiver, which is situated at a height of 43 ms.* The highest temperature is measured here (270° C at the inlet and 540° C at the outlet). The thermal output of the receiver is 2.7 MW at a mass flow of natrium of 7.3 kg/second.

Interest was centered principally on whether the solar-specific components of the plant, the mirror field with its controls and receiver, were functioning as calculated. After the mirrors had been cleaned twice, the measured values agreed satisfactorily with the precalculations. Longer term observations will provide information about the problem of mirror contamination.

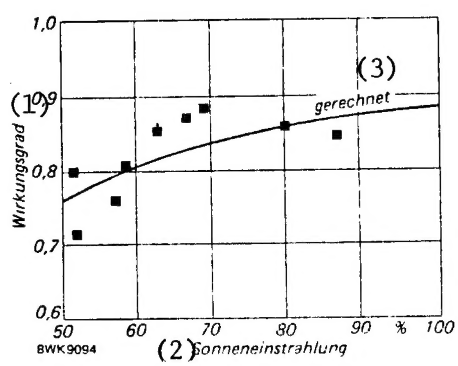

Figure 1. Receiver Efficiency--Calculate and Measured Values

Key:
1. Efficiency
2. Solar irradiation
3. Calculated

Figure 1 shows that the measurements of receiver efficiency exhibit some scatter, which can be attributed partially to the effects of the wind, but that the receiver is meeting theoretical expectations fully with respect to its thermal performance. The flexibility of receiver operation was confirmed: It can be turned as the sun, the mirror field or the rest of the plant require and, apart from the heating up and the subsequent filling with natrium, needs no special attention.

Separating the natrium circulation system from the water-steam circulation system has also proved itself. It is assumed that the independence of the two systems will simplify further operation considerably and will be of great advantage with changing irradiation or variable current requirements.

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*See: D. Stahl, H. Weizenkamp, H. Fricker, "Design of a Natrium-Cooled 2.7-MW Receiver for a Solar Power Plant," BWK [BRENNSTOFF-WAERME-KRAFT] 33 (1981), No 11, pp 451-454.

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CSO: 3102/363

ENERGY

BRITISH PLAN THREE MW WIND GENERATORS AT ORKNEY ISLANDS

Duesseldorf BWK: BRENNSTOFF-WAERME-KRAFT in German May 82 p 250

[Text] The Orkney Islands off the north coast of Scotland could one day become the wind energy center of Great Britain: The North of Scotland Hydro-Electric Board is planning the construction of several wind-powered generators of up to 3 MW here.

In December 1980 a 22-kW wind-powered generator began operation here, which had generated about 13,370 kWh for the island network here by March 1981--with an average output of 12.86 kW. The longitudinal-axis machine is eminently suitable for unsupervised operation and achieves a respectable output at wind speeds of between 5 and 40 ms/sec. Rated output is achieved at wind speeds above 13 ms/sec.

The next step in the program will see completion of construction of a 250-kW prototype model (20 ms diameter) by the end of 1981. The plant is the forerunner of the first 3 MW wind-powered generator (60 ms diameter), which has been planned for the same site--a 170-meter high rise, about 2 kms from the exposed north coast of Orkney Mainland. The 250-kW plant uses a double rotor blade arrangement and will reach its full output at wind speeds of between 17 and 27 ms/second. The prototype is being built jointly by the Wind Energy Group, GEC Power Engineering and British Aerodynamics, with the assistance of the British Ministry for Industry and the Hydro-Electric Board. Estimated costs are about 1 million pounds sterling.

The 3-MW plant is to be ready for operation in 1983-84. About 5.6 million pounds sterling are being set aside for it, according to the terms of the financing plan; the British Ministry for Energy is assuming 4.6 million pounds sterling of the cost, and the Hydro-Electric Board is contributing the remaining million pounds sterling. The 3-MW machine is designed as a twin-rotor blade machine, with a longitudinal axis. The rotor blades are rigid for 80 percent of their length, the outer 20 percent can be continuously trimmed to control power output. The machine is designed for 30 revs/minute at wind speeds between 8 and 27 ms/second and for a rated output of 3 MW at wind speeds of 17 to 27 ms/second. The rotor axis will be 45 ms above ground. This is one of the highest wind-powered generators built so far, with a height of 75 ms from the base to the tip of the upright rotor blade.

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ENERGY

INCREASE IN FRG FUNDING FOR ENERGY RESEARCH

Duesseldorf BWK: BRENNSTOFF-WAERME-KRAFT in German May 82 p 250

[Text] The "Second Program for Energy Research and Energy Technologies" was passed by the government after several delays. It includes all the measures in research, development and demonstration receiving government support between 1981 and 1985 in the area of energy. The second energy research program is marked by a substantial planned increase in subsidies. As usual, it is subject to the approval of the Federal budget each year and of financial planning. Taking the Federal budget for 1982 and financial planning until 1985 as a basis, and including expenditures for 1981, more than DM 12 billion will be spent on the program from 1981 to 1985. That means funds have been almost doubled compared with the first program (1977 to 1980).

The financial dynamics results from sharply rising investments in the rational use of energy (1981: DM 155 million, 1985: DM 230 million) and principally from the substantially increased funding for coal conversion, which is set to increase from DM 96 million last year to DM 835 million by 1985; most of this will go to coal gasification (1982: DM 166 million, 1985: 672 million). The Ministry for Research and Technology points out that in the area of coal conversion the expensive phase of demonstration and prototype plants is just beginning in the 1980's, to prepare the way for large-scale technical utilization.

By contrast, state supported research for prototype and demonstration plants, particularly in nuclear areas, will come to an end during the 1980's, affecting, for example, uranium enrichment and--with the start of operations of the THTR [thorium high-temperature reactor] 300 and the SNR [fast breeder reactor] 300--the Advanced Reactor Lines. Their continued development, as was announced in the Third Assessment of the energy program, will have to be taken over by the industry. The energy research program provides an increase for the Advanced Reactor Lines this year from DM 701 million to a total of DM 808 million in 1985, but the funds just for high-temperature reactors are falling from DM 298 million to DM 226 million in 1985.

Support for renewable energy sources is being continued. It is intended to benefit not only German energy supplies, but also to create solutions for the Third World and open up chances for exports.

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BRIEFS

SWEDISH WIND POWER--Sweden is investing in a new generation of wind power plants. Vattenfall and Sydkraft will give Kamewa and Vindenergi respectively the task of developing a new generation of large wind power plants. The work means that Sweden is improving the conditions for maintaining its international leadership in the wind power field. This can also mean that power companies will not wait for the Riksdag energy decision of 1985, but will order wind power plants in 2 years, in 1984. After one year's deliberations the parties concerned have reached an agreement which in brief looks like this: The government will contribute 5 million kronor. This amount will go via the wind scientists at the Agency for Energy Production Research to Vattenfall, which will give Kamewa the task of adapting the prototype power plant which is to be put into operation at Nasudden on Gotland in the fall. Vattenfall will invest one million and Kamewa 2.5 million kronor. Sydkraft will give Svenska Varv/Vindenergi the task of adapting the Maglarp prototype in Skane which will be put into operation in the fall. Vindenergi will also invest 2.5 million and Sydkraft one million kronor. In 1983-84 the foundation will be in place for determining the economic and technical preconditions for wind power. The arrangement means that the power companies will have the basis for decision earlier than was planned by the politicians, and that the export possibilities of the Swedish industry are improved. [By Mikael Holmstrom] [Text] [Stockholm NY TEKNIK in Swedish 3 Jun 82 p 2] 9287

CSO: 3102/390

AUTOMATION FOUND THROUGHOUT PLASTICS PROCESSING INDUSTRY

Paris L'USINE NOUVELLE in French 3 Jun 82 pp 94-98

[Article by Pierre Laperrousaz: "Plastics Processing: 'Fully Automated' Tomorrow"]

> [Text] Computer-aided design, automated tool manufacturing, robots for secondary tasks (unloading, sprue removal)... Management by a central computer. A utopia? No, these techniques already exist. All the plastics processors have to do is use them.

What will a plastics processing plant look like at the end of the present decade? What tools will help the processors maintain their competitivity? According to Jean Laurent, assistant general manager of SMTP[expansion unknown]-Billion, "tomorrow's industrial complex will be ruled according to three principles: quality, reliability, flexibility."

Quality means the optimization of parts geometry to ensure service performances, the use of a minimum of material, and optimum molding conditions. To achieve this difficult operation, the processor will have one tool at his disposal: computer-aided design (CAD).

Reliability means that the quality obtained will be maintained in spite of increasing processing rates; the answer will lie in automation and robotization which eliminate the disruptions due to the human factor.

Flexibility of processing will become mandatory in view of the increasingly diversified requirements of the clients and will require an extremely versatile tool: the flexible workshop.

Equipment manufacturers, control engineers and computer specialists are already making plans. In the design department of the plant of the future, the parts are designed and drawn by a computer which also determines their molding conditions as a function of the processing capabilities of the enterprise. These numerical data are transmitted to the production department. They are fed into the numerical controls of the machines which manufacture the tools (data on part geometry) and to those which manufacture the parts (molding parameters for injection presses, for instance). In this processing workshop, the production

tool itself is supported by all conceivable sorts of peripherals which make it into a flexible workshop: centralized raw material feeding system, manipulators to extract the parts, and even more sophisticated robots to carry out secondary tasks (sprue removal, assembly, palletization, etc.), automatic mold changing devices, automatic quality control stations, etc. A central computer will manage all the machines and collect from each of them the data necessary for production management (operating rate of the machines, number of parts produced, rejects, etc.).

These various stages in the production of a part do not necessarily take place at the same location. A client may well design his part and the tools required, then enter the digitized data on any medium (tape, diskette), or even transfer them in real time to the toolmaker or to the molder.

A utopia? Most of the "building blocks" for the construction we have just described are already available (besides, not all processors will need every building block). Thus, for CAD, numerous softwares have already been developed for metallic parts and could be used for plastics. In tomorrow's plant, the computer will aid in designing the parts as well as in designing the tools. This will take place in a closed system where successive iterations will be used to determine the geometry that will meet the part specifications with a minimum use of material, and to define optimum molding conditions. The advantages are many: savings of time at the design department, no unpleasant surprises when the mold is put into service, savings of material, as well as cycle time reduction (since the cooling time of a part is proportional to the square of its thickness). In addition, thanks to the powerful performance of CAD, the designer can always examine several solutions or variants of the same part simultaneously, or make last minute changes. Now, as John Wood of General Electric Plastics Europe points out, "when the first 5 percent of the development work on a new product are completed, 85 percent of the product characteristics, performances and costs are determined." The first stages in part design are therefore extremely important.

At present, only a few examples of CAD-designed plastics parts are known: the brake pedal of the Vera, an experimental vehicle of Peugeot, is one of them. And whereas a system like Moldflow has had the merit of making users aware of the importance of mold design, it represents only a first approach which could be improved in many ways. At any rate, there are still no closed part-design or mold-design systems.

In this field, research takes place at several levels. At systems suppliers, of course, at users (especially in the automobile industry), and also at machine manufacturers. "It is impossible for a press manufacturer not to show any interest in the design of the part or mold, contrary to what is the case in metal fabrication," according to Jean Laurent who, for the moment, chooses to remain discreet on an important program now in progress in the plastics industry as a whole.

General Electric, a manufacturer of technical-grade plastics (with its General Electric Plastics subsidiary) and of data-processing systems (with GEIS [expansion unknown], SDRC [expansion unknown], Calma), owed it to itself to be represented at the last Europlastique show. It introduced a parts and tools CAD

system incorporating the various softwares available to the company (including Moldflow and Moldcool to design the rheological and thermal characteristics of the molds). This system provides directly the punched tape necessary to manufacture the pattern cavity. It also makes it possible to visualize (through shades of colors) the stresses induced in a part by a given load.

Another project illustrates what an integrated CAD system could be. This is the PROCOOP system (Capacity Software Packages for Plastics Objects and Tools), a project developed by ANIFOR (Association for Continued Training in the Plastics Industry) and CISI (International Data-Processing Services Company) as its technical partner. This project--the outcome of an inquiry with several tens of manufacturers--has received the support of ADI (Data Processing Agency). Jean-Marc Maucotel, the Association's manager, explains: "It is a modular chain system which, when used in its entirety, can cover all CAD and CAM [computer-aided manufacturing] tasks relative to objects and the tools they require (visualization of the flow into the mold during injection; mechanical and thermal behavior of plastics objects under conditions of actual use). Our objective is to place CAD/CAM within reach of small and medium-size enterprises by providing them 'a la carte' access to this system."

At first, the whole PROCOOP system will be offered on the CISINET network of CISI. Depending on his needs, the user will be able to use one or several sub-systems (computer-aided design, computer-aided drafting, flow, behavior, computer-aided manufacturing) or the system as a whole. In a second stage, it will be possible to transfer several conversational functions to the users' premises; depending on the means at their disposal and the importance of their needs, the latter will then be able to work entirely in remote-batch processing or to distribute the functions between central locations (CISINET networks) and their own premises. "We cannot expect to build everything from scratch," Jean-Marc Maucotel indicates. "On the contrary, we shall make maximum use of the softwares existing on the CISINET network to construct each of the sub-systems. For instance: Systrid for CAD, Condor for CAM, Castem, including Plexus, for the behavior of objects and tools and flow-visualization (motion, stresses, velocities, vibration modes, or buckling, response to impacts); Thermix for transient and permanent thermal characteristics (temperature map)."

If need be, these softwares will be linked automatically by interfacing and data-base modules. In addition, several of them will have to be adapted to take certain "molded" geometries into account, or to take into account the rheological models characteristic of plastics (thermosplastic, thermosetting, even composite materials).

Of course, it will also be necessary to create, then to manage, a data bank on plastics that will be integrated to the system and could also be used separately. This is one of the largest items in this project; the work involved in collecting, determining and controlling these data is enormous and it is not unreasonable to contemplate doing it on a European scale...

"We are preparing specifications for the characterization of materials," they say at ANIFOP. Assuming that PROCOOP is actually realized, the question will arise as to how to take into account other softwares developed elsewhere, especially in the automobile or aeronautical industries.

"We are in favor of the project," Raymond Gonard, of Peugeot's Scientific Design Department, says, "but we do not see as yet how we could link it to our system." Anyhow, the need expressed by manufacturers is real and a modern solution will have to be found.

Increased Number of Injection Molding Workshops With Central Computers

The non-linear mechanical behavior of plastics, with considerable deformations, will require an adaptation of the design methods to the elastic behavior of metals. And the problem will get only more complicated in the case of anisotropic composite materials!

Finally, much progress remains to be done in the automatic three-dimension interconnection into finite elements and in its automatic reactualization during the iterative design process. Not to mention compatibility between the various CAD systems now on the market. But these problems do not concern plastics only!

After it has been designed by the full power of computers, the part enters the manufacturing cycle. At this stage too, it will still be under computer care in the workshop of the future. A very near future since, less than a year from now, France will have several injection workshops where all the machines will be connected to a central computer in charge of monitoring and managing all of them.

In a centrally managed workshop, it is possible at all times to access a machine terminal from the central station in order to check the progress of the cycle, find out how production is progressing, check the adjustment program, etc., through a display on a video screen. The computer also provides a management function. For this purpose, it collects statistical data concerning:

- The machines: breakdown of time (production, downtimes, adjustments, miscellaneous shutdowns: mechanical, hydraulical, electrical). These conditions are identified automatically through programmation tricks or, if that is not possible, manually, through the keyboard.

- The molds: time of use, number of injections, average cycle time, proportion of rejects, etc.

All these data are of course very useful to maintain the production tool and manage production. But at present not all data are recorded automatically. For rejects, for instance, automatic control stations would be required, although, to a certain extent, self-adaptive controls (of the CPI [expansion unknown] or dK-Codim types)--which, for each injection, compare the actual profile with an ideal profile--can distinguish the good parts from the rejects.

Depending on the size of the enterprise and the data-processing means available, the central computer is used as a "preprocessor" providing data to a higher-level computer, or it is in charge of most of the production management. All manufacturers are making a point of offering systems which will permit all possible configurations. Thus, dK-Codim has just sold 9 presses equipped with

its Module 6 to Mecaplast (Monaco); these are intended for a workshop which will eventually include 30 presses (old and new) under centralized management. However, Mecaplast has not yet made a decision as to its central station configuration (the system also provides remote diagnosis for remote maintenance by the manufacturer).

The Ordimat system of SMTP-Billion is using as its central unit a PDP-11 (23 or 24) minicomputer from Digital Equipment which can easily be connected to a more powerful system. This company, located in Oyonnax [department of Ain], has developed on its own an operation software which, in addition to the mere gathering of statistical data, also ensures the management of technical production means (presses, tools, etc.), that of times, expenses and internal orders, and production follow-up. This is a true production management software which, for instance, makes it possible to check the feasibility of an order depending on the existing workload, or to find out the state of progress of an order, or again to modify a manufacturing program to take rejects into account, etc. The first such system will become operational in the fall of 1982 on a total of nine presses equipped with Visumat 4000.

This configuration, including a master computer and slave machines, each with its own numerical control, will prevail for a long time to come. "We do believe that process automation will remain at machine level, the central computer assuming only management tasks," Philippe Pertuis, of SMTP-Billion, says. The adjustment programs are entered through the machine terminals or transmitted from the central station. But the part played by the latter in machine control is restricted to on/off orders (which might be programmed). A schema of this type has been adopted for the system which CPI will deliver to La Telemecanique (seven machines managed by a central CPI-70 station).

Machine control in tomorrow's workshop will of course use microprocessor capabilities. The most recent of the systems available today are already giving a good idea of what it will be like. Compared with the first generation (1978), they have a greater processing power because they use a larger number of microprocessors. In the same way, sensing devices (infrared probes for material temperatures at dK-Codim, for instance) and hydraulic devices (systematic use of servo-valves) are better adapted. The displaying of adjustment parameters through the keyboard, their visualization on a color screen through synoptic diagrams, graphs, etc., and their storage in memory on various media (cards, reprogrammable read-only memories, bubble memories, etc.) for future production runs, make the user's task easier.

The closed loop control is replacing the so-called "open" loop control. "The debate as to which of the two systems is better is no longer relevant," Jean-Paul Bras, technical manager of dK-Codim, states.

Debate on Self-Adaptive Control

Another debate promises to yield exciting controversies: for or against self-adaptive controls? For the proponents of the latter (dK-Codim, CPI), the question is settled: why do without an improvement which, undeniably, provides a greater regularity in parts?

The self-adaptive control does in fact correct injection parameters during the cycle proper, depending on the deviation of the actual profile from an ideal profile. Thus, the small variations in viscosity due, for instance, to changes in the material or to a sudden temperature variation can be taken into account. "In some cases, we have noted an improvement by a factor of two or even five on the standard deviation of part weights," Jean Azarian of CPI states. And Ari Sayag of Mecaplast, who has purchased the competing device from dK-Codim, adds: "We could not manage to produce rejects, although we purposely introduced perturbations." But Philippe Pertuis disagrees: "But the most urgent task, if we want to improve the overall performance of the workshop, is not to aim at such a high level of automation. For our part, we choose to approach automation in the broader context of integration of the molding process with upstream and downstream operations." He admits that self-correcting algorithms are "operating" in the lab at Oyonnax. This view, maybe more realistic, certainly more prudent, is shared by other manufacturers, such as Battenfeld.

In tomorrow's workshop, the machine proper (i.e. the machine that forms the material) is only a sub-assembly in what we might call a production cell. Around it, a whole series of peripherals are operating; they may or may not be provided with individual automatic systems, but they are all connected to the machine control. They include manipulators for insert addition and/or part extraction, mold changes, sprue removal, assembly, marking, deburring, weighing stations, etc. The distribution of materials is centralized and their coloring automated, which reduces waste, handling and inventory. The mold-cooling system is also centralized. As at the new Mecaplast workshop which also includes six material-distribution circuits.

One such plant "without operators" is now being designed by Cincinnati Milacron in the United States, for the injection department of a multinational company. In this project, the operator in charge of supervising mold changes (the molds being brought on wire-guided carriages) is alone in the workshop. Another operator is in charge of the mold inventory. The control of finished products is also automated, thanks to a video shape-comparator. In fact, this plant is just a collection of technical means which are already available. Most press manufacturers are now working on a mold changer; some have already realized one (Billion, Battenfeld, Toshiba, etc.). Until now, the demand has not been very large, but this should change. Indeed, when the memory storage of adjusting parameters makes it possible to resume production within a few minutes, it becomes senseless to lose several hours changing tools. The manufacturers' design departments have re-examined the problem by studying automatic connection devices (mechanical, hydraulical, electrical) which are more reliable and adaptable, even on older tools.

At SMTP-Billion, the two halves of the mold are mounted on standard plates which carry the hydraulical and electrical connections (up to 16 conductors). Symmetrical plates are provided on the press plates, and the closing motion also closes the connections. Simultaneously, lateral jaws mounted on the press plates block the tools in position and the (central) ejector pin is locked on. For tool-safety reasons, the jaws are actuated by springs when they close and by hydraulic jacks when they open. "For the moment, this

quick mold-changing device is semi-automatic since the tools are still brought in manually, by a hoist. However, we are contemplating a fully automated system, where the tools will be introduced through the top of the press, or through the side, depending on the dimensions and size of the mold," Bernard Monet, development manager at SMTP-Billion states.

At Toshiba, such a system is already operational, as could be seen at the last Interplast show. When a given production run is almost completed, the press control module discontinues material-feeding to the machine ahead of time and, after the last cycle, triggers the change of mold. The mold is brought in laterally on a roller table. According to the same principle of rapidly starting new production runs, devices to preheat molds will be developed and, quite naturally, their design will be derived from that of previous systems. The concept of flexibility can be carried still further and "quite possibly, one day, we will design modular systems in which the plastification unit itself could be automatically exchanged," they say at SMTP-Billion.

Convincing Arguments in Favor of Robots

As can be expected, robots will be present everywhere in the workshop of the future. Their use has already been rehearsed on a few occasions, to unload injection presses at several French processing plants. Certainly, most of them do not deserve the name of robot. In fact, they are automatic manipulators with pre-adjusted cycles. They grab the parts by means of suction pads or clamps and extract them from the mold through simple motions, in most cases along Cartesian coordinates, with a few rotating motions (or "wrist" movements): enough to orient the part once it is taken out of the mold and place it on a conveyor or, more seldom, on a sprue-removal, marking, palletization device, etc. In the less sophisticated models, the sequence of motions is controlled by a simple logic, and the length of each motion is adjusted by means of stops, switches, cams, proximity-effect sensors, etc. The more advanced models are provided with a numerical control and follow a program recorded through a keyboard (and which can be modified at will). Less common manipulators are operating along "circular" coordinates: they extract the part through translation motions, then disengage it by a rotation.

Manpower savings, less rejects, increased production rates, improved safety, these are the arguments most often put forward by the proponents of robots: the manufacturers and, more convincingly, present users. According to Jean-Louis Moreau of Sepro, the only French manufacturer, "the reduction in downtime for unloading is especially noticeable with large presses (at least 300 tons), and when changing shifts." In some workshops, up to 40 minutes per day could be saved; generally, gains of 5 to 12 percent can be expected. These statements are confirmed at Allibert (Meru plant), where 12 Star Seiki robots (from Japan) have been in service for a few months already. On a 1,700-ton press, the rate of production has increased from 52 to 60 parts per hour, and the machine cost per part has decreased from 7.21 to 6.25 francs. Over a 5,000 working hours' period, the investment will be amortized in less than 9 months. In the same workshop, a pair of parts injected into two molds placed side by side on a 1,200-ton press are extracted: the elimination of 3 operators and the increased production rates make it possible to expect amortization within 12 months.

An additional advantage is that the almost total elimination of incidents when parts are extracted or discharged (provided the tools are designed accordingly!) reduces the number of rejects: less than 1 percent on a 1,500-ton press molding dashboards for the R-9 Renault. Indeed, as they explain at Allibert, "the molding cycles are so well optimized now that a prolonged shutdown of a machine, for instance after an extraction incident, almost certainly results in a reject on the next cycle." In this sense, the extraction manipulator fits quite well in the logic of a finer regulation of the injection process itself.

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NEW STEEL PELLET MAKING PLANT SAVES ENERGY, MONEY

Stockholm DAGENS NYHETER in Swedish 15 Jul 82 p 9

[Article by Caj Noren, DAGENS NYHETER's Norrland correspondent: "Cause for Rejoicing at LKAB: New Pellet Method Gives Competitive Advantages"]

[Text] Malmberget. The "steel band process" is the name of the new method of making pelletized sinter from ore concentrate. The method is a world innovation in the mining industry, and was worked out by LKAB [Kiruna Mines] Mining Company researcher Roland Drugge at Malmberget. With the "steel band process" investment and construction costs for a pellet works are radically reduced. And while the "old" pellet works require giant facilities the "steel band process" can be built in all sizes and even be made portable between small mines!

The new method of making pellets has been tested for 3 months in a pilot installation at LKAB's old, inactive pit furnace at Malmberget. The results were called very promising.

"But before the steel band process can be used by LKAB in a new pellet works the method must be tested in a medium-sized works with an annual production of up to one-half million tons," said research engineer Roland Drugge, who is head of basic process development at LKAB.

Eight Million

Roland Drugge is a metallurgist, and also an expert on control and regulating techniques, knowledge which he has now put into practice. LKAB has invested eight million kronor in the new method which can give the company large future competitive advantages.

In a conventional pellet works the rolled pellet balls are transported to powerful ovens in a large number of heavy steel wagons which look like horizontal escalators.

The heavy material means a very large investment which demands large structures, and an extensive and costly foundation.

In the "steel band process" Roland Drugge has exchanged the heavy so-called roasting wagons for a 1.5 millimeter thick steel band. The technique of "baking iron balls" was taken partly from modern bakeries where buns are baked on steel bands!

In a pellet works they are dealing with temperatures of over 1300 degrees. In order for the steel band to withstand such temperatures Roland Drugge has found his own trick. The thin steel band is protected by a bottom layer of already roasted pellets, and furthermore the steel band is perforated with crosswise slits.

"In this way the band can withstand the high temperatures without buckling," said Roland Drugge.

The new "steel band process" is used with LKAB's energy-saving so-called warm front technique which is used in the pellet works at Malmberget and at the new KP 79 at Kiruna.

This technique has also been developed by Roland Drugge.

The warm front technique means that with the help of computers a "warm front" is created between the lower layer of already roasted pellets and the ore balls that are to be roasted.

"The hot gases are simply drawn in and transfer their heat in a sharp warm front to the bed of pellets on the steel band," said Drugge.

The fully automatic pellet fabrication is controlled by a computer. It only requires one person to watch over the process in a control room.

The pilot installation at Malmberget has a capacity of 50,000 tons per year.

"A natural size for this type of pellet works is an annual production of one million tons. But technically there is no upper limit to how large a works can be built," said Roland Drugge.

The investment cost for a pellet works has tripled during the last 10 years. Therefore it is necessary to build new installations which will produce at least three million tons of pellets per year for them to be profitable. That means an investment cost--today--of about one-half billion kronor.

One-half

"With the steel band process the investment cost will be halved," said Roland Drugge.

Such low investment costs in combination with the new warm front technique should, he believes, give LKAB decisive competitive advantages.

Today, for example, LKAB uses six liters of oil to manufacture one ton of pellets with the warm front technique. LKAB's "worst" competitor on the European market, Brazilian CVRD, uses 36 liters of oil to make the same amount of pellets.

LKAB has the total capacity to manufacture nine million tons of pellets per year.

This is only one-third of the firm's estimated future iron ore production. But today, because of the steel crisis, only about 70 percent of the capacity of LKAB's pellet works is being utilized. Still, Roland Drugge believes that in the long run LKAB must expand its pellet capacity "appreciably."

"I believe that LKAB will make pellets of all of our estimated production of 25 million tons per year. We are strong in pellets, and we can be even stronger in the future. We have a technical advantage, and a unique ability. This means that we can produce the market's best pellets at the lowest known oil costs," he concluded.

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CSO: 3102/390

MINISTER SPEAKS ON R&D, STATE AID IN KEY TECHNOLOGIES

Duesseldorf CHEMISCHE INDUSTRIE in German May 82 pp 273-275

[Interview with Dr Andreas von Buelow, minister for Research and Technology, by CHEMISCHE INDUSTRIE: "Create Knowledge--Support Innovation"; date and place not specified]

[Text] CHEM IND: The yardstick of a responsible research policy must be long-term development trends. These are to be viewed against the background of competition in world markets by FRG enterprises. What possibilities does the Federal Ministry for Research and Technology (BMFT) have for observing and analyzing worldwide scientific and technical developments? To what extent do contacts with universities, scientific societies and other information sources constitute bases for evaluation of development trends and for decisionmaking?

Von Buelow: The political determinations of the main focuses of research and development policy rest, on the one hand, on discussions with the world of experts and [technical] society groups and, on the other, on analyses and predictions including the international situation and development. Possibilities for observing and analyzing worldwide scientific and technical developments and preparing these for research policy are extremely varied. In addition to analyses, predictions and reports worked out in-house, each year orders amounting to about DM 2 million are placed for the purpose of research planning. Besides predictions and analyses spanning several areas, synopses and evaluations in individual technology areas are significant. As a rule, these are carried out in enterprises, universities and scientific institutes. From these, proposals for the next research programs, main focuses of support, or applications for support are developed and sent to the BMFT. To examine such proposals and applications right through to a decision, the BMFT supplements its own expertise by drawing on project firms and outside consultants. These discuss and advise, usually in expert circles, specialized field and ad hoc committees whose makeup is given out in the adviser plan appearing annually.

CHEM IND: The FRG's chemical industry, as well as plant and equipment construction, rank among the technologically leading branches of their kind in the world. To maintain this position, however, constant research and

development efforts are required. These can exceed the financial capacity of a single enterprise or even of an entire branch of industry. Where do you see the field of application and the limits of government research support?

Von Buelow: Research and technology policy supports industrial research and development in those areas and tasks where the risk cannot be borne alone by business or enterprises and which are of advantage to our society. Where these conditions are met, that is, which areas of technology have become main focuses for support, is decided on the basis of the objectives of overall policy in which the research and development policy is imbedded. Today, for the first time, we are facing a challenge to remain internationally competitive through development and application of key technologies, e.g., microelectronics, biotechnology, optical signal technology and the energy technologies. In the intermediate and long term, only this effort will create and assure our jobs.

Second, we must through development, structuring and application of new technologies make the work environment more humane to man, protect our natural environment, reduce existing environmental pollution, and--not last--use energy and raw materials efficiently. High-risk developments and constant innovations which open up economically broad fields of application must be stimulated. Here, public support can only give incentives and assistance for self-help. This support is also of significance for future-oriented developments of the chemical industry. Here I refer to direct and indirect support measures, as well as to basic research support in institutions from which new incentives and qualified expert knowledge result.

In the years 1972/1973, for instance, the "DECHEMA Deutsche Gesellschaft fuer chemisches Apparatewesen e. V." [German Society for Chemical Equipment, Registered Association] and additional experts from industry and science worked out a study on biotechnology which can be called a forerunner of the "biotechnology" main support focus. Also, in carrying through area programs and in project control the BMFT obtains insights which are needed for planning. At the so-called status seminars which are held to evaluate and transmit project results, experts and interested persons who do not participate in the projects also take part.

Insights in the decision process in each case are developed from the varied contacts during planning and carrying out of programs and projects. They form an important basis for responsible research policy.

CHEM IND: Actual areas of research and development activities of the FRG's chemical industry and plant and equipment construction are, among others, biotechnology, coal refining and further development of other processes which contribute to saving raw materials and energy. How does research support by the Federal Government look in the area of biotechnology, and what are future plans? Is there sufficient scope for supporting genetic technology in case of a future additional shortage of public funds?

Von Buelow: Biotechnology is an important key technology for the coming years. It will assist us in mastering the challenges of the next decades in food supply, environmental protection, medicine, and energy and raw materials production. Despite the BMFT's efforts to support basic research and a few biological developments within the scope of project support, the situation is not yet satisfactory in comparison with industrial countries competing with us internationally. We must meet the increased efforts of these countries. The Federal Government therefore grants a high priority to the support of biotechnology.

For 1982 a total of DM 55 million is now available for project support. The increase over 43 million in 1981 is essentially to be used for the further extension of genetic technology at universities and in industry. Inasmuch as this is only a first step in the efforts to catch up with international developments, I shall endeavor to obtain a further increase in funds. Above all, new methods in biotechnology are to be developed and tested in the next 2-3 years. These new technologies must be introduced into industry, agriculture and medicine. I consider it important for the main focuses of research to be worked out in the dialogue with industry and the scientific organizations.

CHEM IND: According to your own statement, headlines about sinking oil prices cannot be the yardstick of a responsible energy policy. What priority do you grant to further research support of coal refining? What possibilities do you see for preserving the research and development work done to date in the areas of coal hydrogenation and coal gasification for the future, despite the lack of profitability which results from calculations based on German hard coal?

Von Buelow: The yardstick of a responsible energy policy is the long-term protection of our energy supply. This objective has been followed by the Federal Government for years. With that in view, as stated in the 2d Energy Research Program, we grant increasing significance to coal refining. At a time when the price ratio of coal and oil was still considered less advantageous than today for our domestic coal, the BMFT took up the support of coal hydrogenation technology, fully aware that no miracles were to be expected in the short term with regard to competitiveness of this technology. Several processes for gasification and liquefaction of coal have been further developed during the last 8 years and tested on a pilot scale. The next steps also include the question of commercial-size prototype plants. In the case of brown coal plants for the production of synthesis gas, the profitability limit has already been reached. Gas production from hard coal will be economically viable only with public support for the enterprises. For the coming years the Federal Government has made available about DM 1 billion in this sector. The technological breakthrough to commercial size is thus prepared for coal gasification.

The results of preliminary project studies on the large-scale technology of coal liquefaction clearly show that profitability cannot be reached here in the foreseeable future. On the other hand, this technology is of great industrial political significance for the FRG. In the future a large market may be expected to exist for such plants in countries with cheap coal, and thus an important export area can be opened up for the German economy. Still this year, the Federal Cabinet will consult on how the coal refining program should be continued; coal refining holds a high rank in the new energy research program and in the planning of financial support funds.

CHEM IND: What are the main focuses established by your ministry with regard to support of additional processes for saving raw materials and energy?

Von Buelow: The future support of research and development work in the industrial area will continue to follow the objectives of reducing energy consumption, increasing the efficiency of energy used, and using waste heat. Included in this are such interesting research and development main focuses as reduction of energy consumption by energy-intensive plants and energy-intensive processes, new energy-saving production processes, and new processes and plants for using industrial waste heat sources, which are of interest to a large number of industry branches and also the chemical industry. Plants for electric current production from waste heat by using low boiling hydrocarbons as the working medium are also significant. Here the chemical industry can contribute a great deal to research and development.

CHEM IND: Particularly in equipment construction, we have intermediate size enterprises whose research should be supported in conformance with the market and without large bureaucratic expenditure. The most suitable instrument for this would be indirect research support, which works by means of a special write-off and/or a subsidy to the personnel budget. Do plans exist for extending the very small volume of indirect research support?

Von Buelow: Federal Government support of research and development in small and intermediate size enterprises amounted to more than DM 800 million in 1981. When this amount is broken down according to initial support undertaken, the following picture results:

- Support for technological peak achievements, within the scope of research and development projects, received approximately one third of the funds spent.

- The increase of the research and development potential with the objective of broad effect, especially by subsidies to the research and development personnel budget, constituted about half of the total support.

- The support of research cooperation through assistance to contractual and community research, as well as measures for improving technology transfers, had a share of approximately 20 percent.

This distribution of funds shows clearly that in each case we offer suitable assistance, which can also be used successfully, for the various problems which are to be found in the small and intermediate size enterprises in the research and development area. Experience of the past years shows that we are on the right path with this differentiated support offer made on the basis of the Federal Government's research and technology policy overall concept for small and intermediate size enterprises. The great publicity received by the special program "application of microelectronics," which has been in force since the beginning of 1982 with a simplified application and accounting process, confirms this. The often-held view that research and technology policy puts small and intermediate size enterprises at a disadvantage because of the bureaucratic procedures involved is wrong but unfortunately proves to be a long-lived prejudice. For this reason, the further development of our concept for the future can and will not be oriented on the immediate argument about direct vs. indirect research support, but instead we will together master problems still existing.

CHEM IND: The ACHEMA [Exhibition of Chemical Equipment] is the most important function of chemical process engineering worldwide and is a central market for exchange of know-how. Do plans exist to intensify and extend international science transfer, that is, cooperation with foreign universities and research institutes, know-how exchange and documentation on worldwide scientific research?

Von Buelow: In its program on the support of information and documentation passed in 1974, the Federal Government singled out scientific transfer as an important objective and initiated the required support measures. Exchange of scientists as carried out, for example, by the German Academic Exchange Service or the Alexander von Humboldt Foundation, the numerous partnerships between German and foreign universities and research laboratories, and the exchange of experience with developing countries within the scope of the German Foundation for Development Assistance (DSE) can be cited as examples. The Federal Government participates in international multilateral information and documentation programs such as UNESCO. This also holds true for the EURONET-DIANE project of the European Community. This on-line data grid, accessible to everyone and preponderantly science-oriented, has been extended to Sweden, Austria and Switzerland above and beyond the European Community. Another significant success was the founding of the Chemistry Information Center, in which the industry participates, on 1 January 1982. Its services are also available to foreign departments. For me there is no doubt that the necessary progress in research and technology will be decisively determined by nationally and internationally available knowledge being made available rapidly and converted quickly into practice, into innovations, into new products and processes.

5586
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FRENCH-ITALIAN ATR-42 PROJECT DESCRIBED

Paris AVIATION MAGAZINE INTERNATIONAL in French 15-30 Apr 82 pp 46-48

[Article by Jacques Gambu: "The ATR-42 Under the Microscope"]

> [Text] Commuter aviation, in the broader meaning of this expression is more than ever on the forefront of events. A new generation of twin turboprop aircraft aimed at a potential market of the order of 2,000 units, is in the making. The ATR-42--the result of a promising French-Italian industrial association--is a prominent member of this new generation. We shall take this opportunity to take a closer look at the technical characteristics of this aircraft, as it now stands.

From a basic airframe including the entire wings, the tail-unit, the propulsion system and the landing gear, Aeritalia and Aerospatiale have developed, first, a standard version, then a few additional versions to answer specific requirements. Apart from that, everything depends on the cabin layout.

Commuter Aircraft

In the commuter version which, in the present state of things, we can call the standard version, the passenger cabin is 13.85 m long and 1.91 m high above the central corridor, which is 0.45 m wide and divides the rows of 4 seats into 2 subrows of 2 seats each. The cabin width is 2.26 m at floor level and reaches a maximum of 2.57 m at arm-rest and window level. The windows are 0.35 m high. The cabin volume is 44.80 cubic meters. The pressurization rate is such that sea-level pressure is maintained up to a true altitude of 4,000 m.

On the basic version, in the cabin layout for 42 passengers with a seat pitch of 0.81 m, we find, from the front to the rear, a first 5.80-cubic-meter bay including two luggage or light freight compartments which can be accessed from the outside through a door located on the left (measuring 1.53 x 1.275 m) and, from the inside, by a small door of a width equal to that of the central corridor.

After that, we find two emergency exits (0.91 x 0.51 m) with the first windows, one on each side, then seat-rows and, at the rear and to the right, a clothes compartment and a buffet. The service door (1.52 x 0.61 m) opens on these

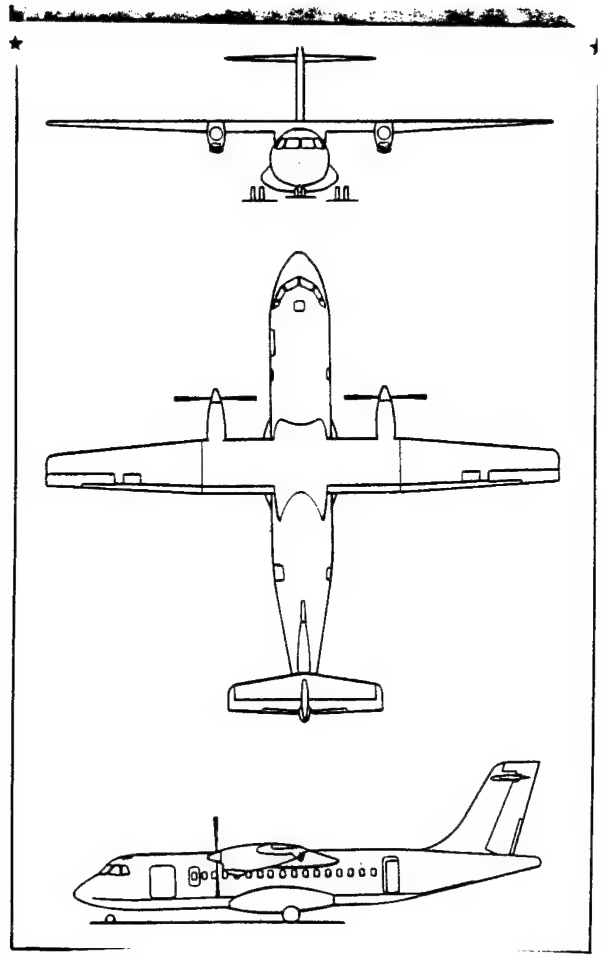

Figure 1. Front, top and side views of the first version.

facilities as well as the rear luggage compartment, which has a capacity of 2.70 cubic meters. On the left side, we find the passenger access door (1.75 x 0.75 m) with its threshold 1.26 m above ground, and a toilet. The hand-luggage racks of the cabin have a capacity of 1.60 cubic meters.

In the 46-passenger version, with a seat pitch of 0.76 m, the volume of the rear facilities has been reduced, whereas in the 49-passenger version, still with a seat pitch of 0.76 m, the volume of the front luggage compartments has been reduced to 3.50 cubic meters, so as to install 3 additional seats. However, the cabin luggage-rack volume has been increased from 1.60 to 1.80

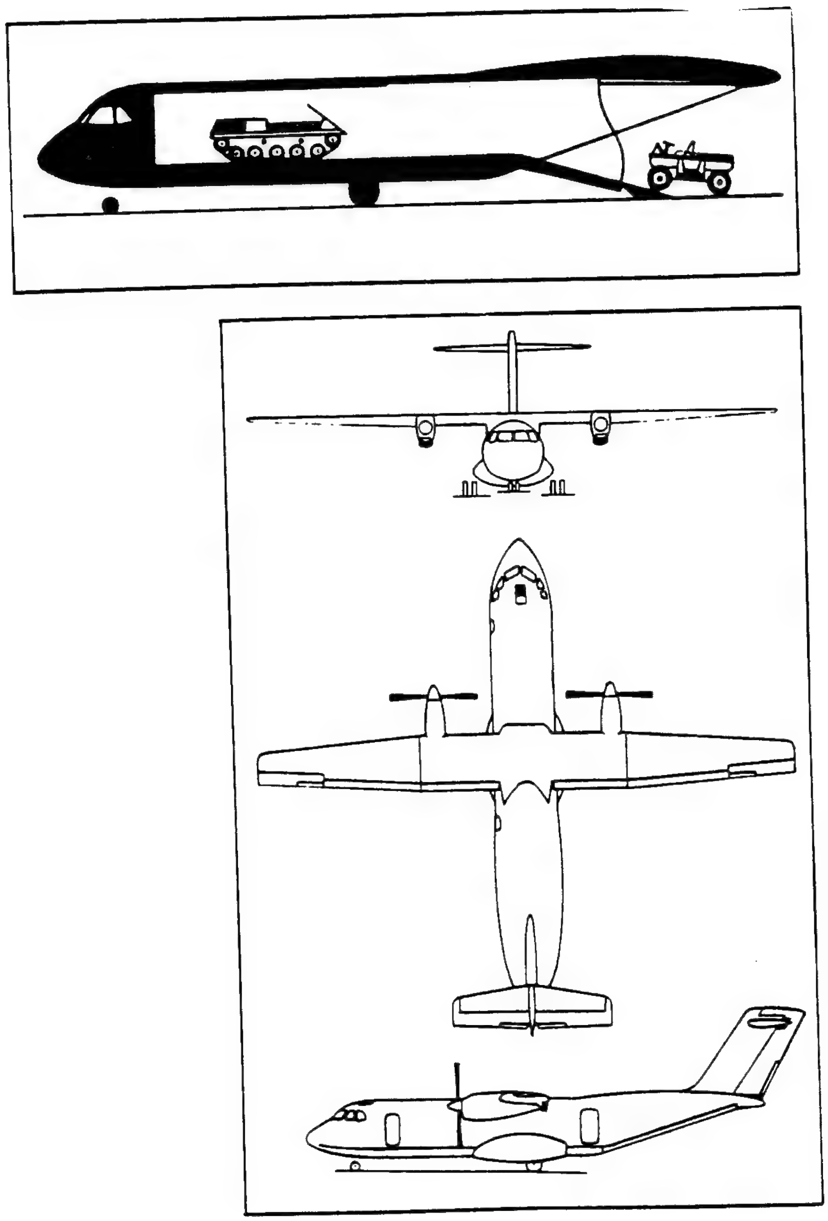

Figure 2. The ATR-42 can easily be converted into a medium-size military cargo plane, simply by modifying the rear section of its fuselage. Top: cross-section of the hold showing the loading system; the loading ramp and the top wall are clearing off the entire hold section. Bottom: front, top and side views of the aircraft.

cubic meters. Finally, the volume available for luggage has been reduced to 8 cubic meters, i.e. 2.60 cubic meters less than in the standard version.

A pure cargo version of the ATR-42, also under study, includes a minimum of modifications. A large rear left door makes it possible to load five LD-3 containers into the cabin transformed into a hold. A front left door allows

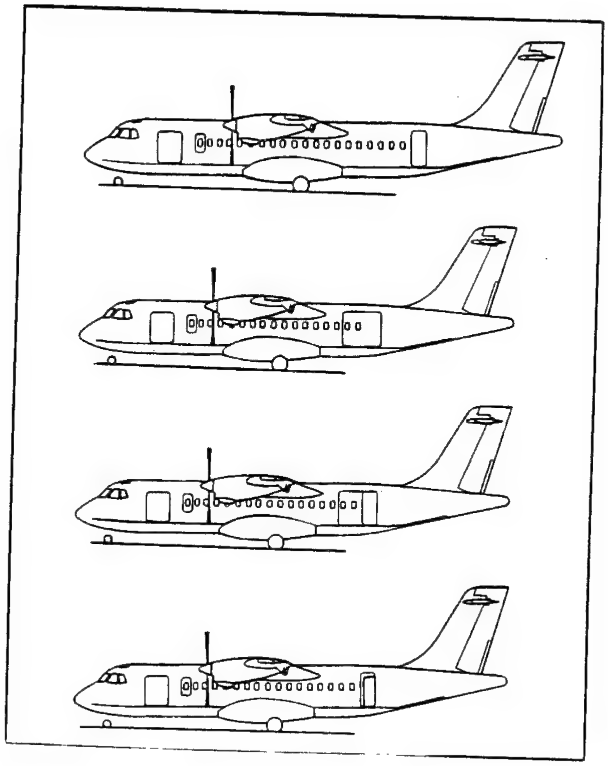

Figure 3. The first offspring of the ATR-42 are shown here. From bottom to top: the standard version; the ATR-42QC "Quick Change" version, available with large cargo doors; the ATR-42F, the pure cargo version; and, finally, the elongated ATR-42XX version of the future. For the military cargo version, see Figure 2 (ATR-42C).

the loading of loose freight, and the rear right service door has been maintained.

The loading and load-handling systems are identical to those of the "quick change" version described below, as are the door and floor dimensions and the hold volume. However, the empty weight is 8,823 kg and the payload 5,282 kg. Of course, the fuel weight and the maximum takeoff weight are identical to those of the standard version.

The "Quick Change" Version

The ATR-42 QC includes a rear cargo door measuring 2.26 x 1.75 m, opening on a ball platform which can accomodate a row of 5 standard LD-3 containers, 1.625 m high and 1.53 m wide. Another front left door measuring 1.275 m x 1.530 m is available, if need be, for light or loose freight. The rear right service door has been maintained. Anti-crash nets are installed forward to protect the two-pilot crew.

The useful floor length is 12.48 m and the available volume 44.60 cubic meters. Retractable latches are provided at the front and at the rear, and lateral guides and latches (all retractable too) along the floor in order to ensure the safe stowing of all loads. In this version, the cabin height has been reduced to 1.89 m and the ceiling luggage-racks are folded against the cabin side.

In this cargo configuration, the empty weight is 9,137 kg for a maximum takeoff weight of 15,240 kg, a maximum permissible landing weight of 14,935 kg, and a payload of 5,785 kg. The payload is reduced to 4,810 kg in the 42-passenger version with a 5.80-cubic-meter front luggage compartment, a 2.70-cubic-meter rear luggage compartment, and 1.60 cubic meter of cabin luggage racks. This general configuration, therefore, is still identical to the standard 42-passenger version.

The FAR [Federal Aviation Regulation] 25 runway length on takeoff is 1,020 m at sea lever under ISA [International Standard Atmosphere] conditions, and 1,165 m at ISA + 20°C. At an altitude of 910 m and ISA + 10°C, the runway length is 1,225 m. At landing, at 0 m and ISA, the required runway length is 920 m.

The Military Version

With the same span (24,572 m) since the wings are the same, this version has a length of 23.20 m and a height of 7.60 m.

However, the entire rear fuselage has been redesigned and the landing gear is provided with 3 low-pressure tire wheels (4.2 bars) which make it possible to use the aircraft from unprepared ground.

This version can be used to parachute 30-36 men--depending on how much equipment and weapons they carry--through 2 opposite side-doors (1.80 m high and 0.90 m wide) which have the peculiarity of opening toward the inside. The men could also be parachuted through the rear ramp which can be opened during flight.

The total volume, including the rear 7-cubic-meter section, is 47 cubic meters. Not taking into account the section corresponding to the rear ramp, the hold is 10.12 m long, 1.89 m high, with a maximum width of 2.26 m. The total floor area is 22.60 square meters.

The empty weight is 9,640 kg for a maximum payload of 4,500 kg. The maximum takeoff weight is 15,740 kg, and the maximum permissible landing weight is 15,430 kg.

As for what the aircraft can carry, apart from the paratroopers mentioned above, the examples are many; judge for yourself: (In the examples mentioned, the load density is 160 kg per cubic meter.)

- 5 LD-3 containers, i.e. 3,795 kg, on four 370-km flight legs without refueling;

- 2 LD-6 and 1 LD-3 containers, i.e. 4,195 kg, and still four 370-km flight legs without refueling;

- 2 LD-11 and 1 LD-6 containers, i.e. 4,500 kg (the maximum load), with three 370-km flight legs without refueling;

- 3 P-2 pallets and 1 LD-3 container, or 3 P-1 pallets, or 2 P-1 pallets and 1 LD-6 container; all 3 examples correspond to the maximum load and, therefore, to three 370-km flight legs without refueling;

- Dropping of equipment such as light vehicles, jeeps, ammunition, etc. It is possible to drop a 1,500-kg load in one piece. The total droppable load is 4,000 kg.

- Medical transport or evacuation of 18 wounded on stretchers with 2 seated medical assistant.

At the weights indicated above, the main performances are as follows: cruising speed at 6,100 m: 500 km/h; operational ceiling: 7,620 m; single-engine ceiling, at ISA + 10°C: 3,780 m; FAR 25 runway length on takeoff at 0 m and ISA: 1,150 m; at ISA + 20°C: 1,345 m; runway length on landing: 895 m. Take-off distances under tactical conditions, with both engines, at sea level, are 580 m at ISA, and 690 m at ISA + 20°C. As for landing, still at ISA and 0 m, it requires only 505 m.

The range, with no wind, at ISA, with 5 percent fuel reserves and 30-minute wait at 450 m, is 1,500 km with the maximum load, 2,000 km with a 4-ton load, and 4,150 km with a 2-ton load.

The Engines

In a first example, the propulsion of the aircraft is ensured by two PW-120 engines now under development by Pratt and Whitney of Canada. This type of turboprop includes two centrifugal (low-pressure and high-pressure) compressors, each driven by a single turbine. Then, we find 2 free turbine stages driving the 3.96-m-diameter propeller through a reduction gear. The ground clearance of the propellers is 1.23 m. The derated shaft power is 1,800 hp and specific takeoff consumption 245 g/hp/h.

This type of engine, of course, is not the only one that can be adapted on the airframe. In the present state of things, the PW-120, the figures published for which are applicable to all versions, seems to be ahead, but political and foreign trade considerations might lead to the use of other engines--although there are not many in this power range--without considerable changes in the aircraft capabilities.

A Few Figures (ATR-42 Standard Version)

- Characteristics. Span: 24.752 m. Length: 22.80 m. Fuselage length: 21.11 m. Height: 7.58 m. Wing surface: 54.50 square meters. Empty weight: 9,296 kg. Zero fuel weight: 14,015 kg. Payload: 4,809 kg. Maximum fuel weight: 4,500 kg. Maximum takeoff weight: 14,715 kg. Maximum permissible landing weight: 14,420 kg. Wing load: 270 kg per square meter.

- Power. Two PW-120 engines from Pratt and Whitney of Canada, of 1,800 hp on the shaft.

- Performances. Cruising speed at 97 percent of maximum weight: 512 km/h at 6,100 m, and 507 km/h at 4,750 m (ISA). Cruising ceiling: 7,620 m. Single-engine ceiling: 4,725 m (ISA); 4,085 m (ISA + 10°C). FAR 25 runway length at takeoff: 950 m at 910 m at ISA + 15°C and for a weight of 13,000 kg, or at 0 m, at ISA + 15°C and for a weight of 14,000 kg, or at 0 m, at ISA and for a maximum load of 14,715 kg. Permissible runway length for a weight of 14,420 kg: 900 m at sea level, 1,000 m at 1,525 m, and 1,140 m at 3,050 m. Flight range with 45 min waiting time and 160-km diversion, with full load and at best range cruising speed: 4,800 km. Range with the same reserves, at normal cruising speed, with 42 passengers: 1,300 km; with 29 passengers: 2,600 km, or eight 185-km flight legs. Range with the same reserves, at normal cruising speed and with a 1-ton load: 4,300 km.

The overall fuel consumption is established at 278 kg for a 185-km flight leg, and 451 kg for a 370-km flight leg, i.e. a ratio of 1 to 1.31 with respect to the DHC-8 "Dash" 8; of 1 to 1.17 with respect to the SF-340; of 1 to 1.38 with respect to the F-27-500; and of 1 to 1.69 with respect to the BAe HS-748, etc.

The program was started in November 1981; European and U.S. certifications are scheduled for 1985, the first deliveries for the second half of 1985, and the 50th unit for 1987.

9294
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FRENCH AVIONICS INDUSTRY UNABLE TO EQUIP ATR-42

Paris ELECTRONIQUE ACTUALITES in French 18 Jun 82 p 8

[Article by G. Bidal: "ATR 42: American On-Board Equipment?"]

[Text] There is every chance that, as far as equipment is concerned, the commuter plane now being developed by Aerospatiale and Aeritalia will primarily benefit U.S. manufacturers, especially Collins. This paradoxical situation illustrates the vulnerability of our equipment manufacturers on the civilian aviation market, in spite of the success of Airbus.

For all French aircraft equipment manufacturers, the ATR-42, to be built jointly by Aerospatiale and Aeritalia, appeared to be an excellent program--and the only such civilian program--to ensure the relay between the present Airbus A-300 and A-310 and future developments in this family (A-320 or TA-XX), at any rate a good way of following up on the civilian breakthrough which actually started with the European aircraft. All the more so as the French-Italian aircraft, still unflown, is experiencing an encouraging start, especially with the orders from two U.S. companies.

However, although the future of the ATR-42 is still extremely encouraging, the hopes of our equipment manufacturers are in danger of being crushed by the selection of U.S. equipment, especially from Collins, for this aircraft.

What are the reasons for this possible setback? First, the market for which the ATR-42 was designed is very varied and scattered; therefore, Aerospatiale designed avionics that are simple and standard enough to be adapted to very traditional configurations as well as to a highly sophisticated flight compartment with automatic pilot, microwave landing system, CRT screen display, etc.

With such very general specifications, which are also derived from the concepts implemented on Airbus, it was no longer necessary for the manufacturers to set up a team to study the basic integration of the equipment. In view of the maintenance factor, this solution amounted to favor the choice, by the client, of a complete package which can be offered only by U.S. equipment manufacturers, in particular by Collins.

One way remained open to the French equipment manufacturers: to unite and offer an identical package. Various attempts were made following the initiative of one manufacturer or another. SFENA [French Air-Navigation Equipment Company] offered to organize a group which included most French manufacturers who had worked on Airbus; it was prompted to do so by the interest shown by Aerospatiale for a top-of-the-line version with an automatic pilot and head-up display of the WGD [expansion unknown] type.

But it appears that differences on concepts as well as on the distribution of responsibilities aborted the attempt.

The latest such group is headed by Thomson-CSF and centers around a CRT screen display, the participants being roughly the same.

The Line Effect

However, time is also working against this French and European solution which requires the overall study of a modular system which not only Collins, but also Sperry and, at the bottom-of-the-line, Kollmann, are offering, so to speak, from the catalogue; and the aircraft is due for delivery in exactly two years...

In addition, every marketing consideration is in favor of Aerospatiale's offering a U.S. package; first, because, to a large extent, the ATR-42 market is in North America (almost 40 percent out of an hypothetical 1,000 aircraft). Second, because its Italian partner may not have the same "nationalistic" reasons to support Italian equipment manufacturers who are not in a position to compete with their French counterparts.

Therefore, it appears that, at least for the first units, a largely French and European solution could result only from a political rather than commercial decision aimed at supporting an industry. Such a decision is unlikely, as is shown by the example of helicopters or aircraft such as Dassault's Falcons; a massive americanization of the equipment is in most cases the price to be paid for exporting and, understandably, in view of the tough competition on this market, SNIAS [National Industrial Aerospace Company (Aerospatiale)] and its Italian partner are not willing to take any risks.

Of course, that would still leave some secondary electronic equipment (engine parameters indicators, various gauges); it is also to be expected that French equipment will be offered in option first, before the development of any top-of-the-line package considered by Aerospatiale, but nothing like a goldmine is to be expected.

Some French equipment manufacturers are even blaming Aerospatiale for demanding a "reliability commitment" for the ATR-42, a commitment which they cannot make without giving up their profit margins in view of the dispersion of the market.

A Shaky Industry

However, our purpose is less to relate the ups-and-downs of the ATR-42 program than to illustrate the overall instability of the French equipment manufacturing industry, at least as far as the "civilian cockpit" is concerned. Scattered as it is among isolated slots, this industry has a hard time keeping up with the U.S. giants, their larger series and the conservative habits of a scattered clientele. And the ARINC [Aeronautical Radio Inc.] standards, which increased modularization of the equipment and were therefore expected to give a chance to newcomers, are beginning instead to look like avionics-integrating machines and, therefore, to reinforce the "line effect." Daily examples of this are provided by the commercial aggressiveness of U.S. equipment manufacturers who have become aware of the interest offered by the Airbus program and are even fighting for basic European equipment for the A-300 or the A-310. It is therefore easy to understand why a company like EAS [expansion unknown] has difficulty in maintaining its line of civilian aviation equipment.

Finally, it is to be feared that what is now happening with the ATR-42 will happen again with future Airbus programs, especially with the A-320. It seems that the solution would reside in a conscious effort at cooperating, on the French and/or the European scale, for technical competence is not in question.

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